

Measurement of photons via conversion pairs with the PHENIX experiment at RHIC

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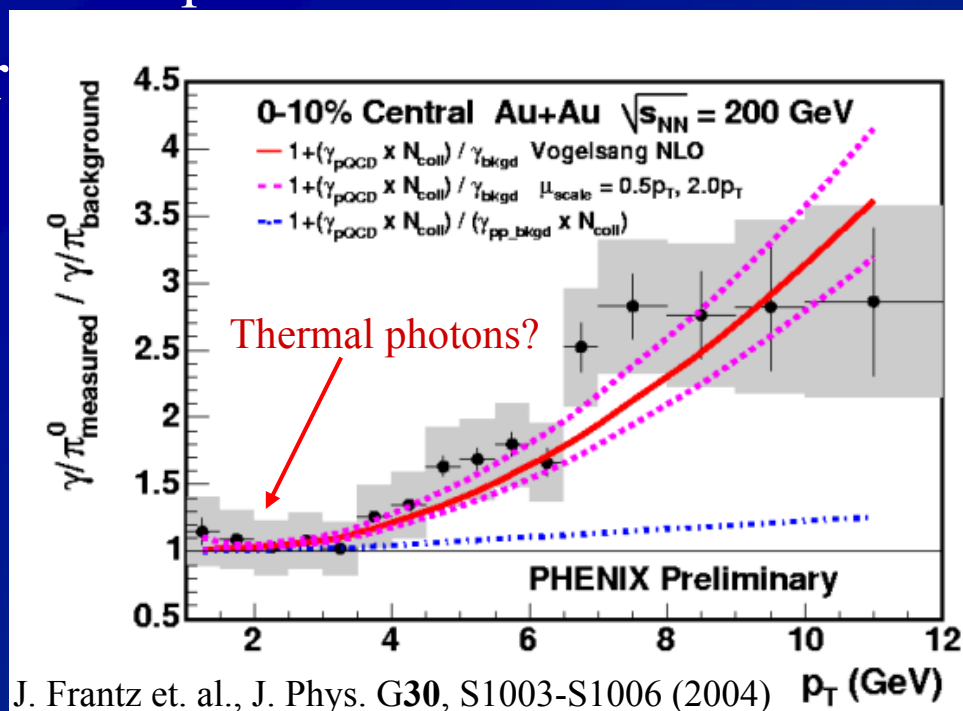
State University of New York at Stony Brook
for the PHENIX Collaboration
at the DNP Fall Meeting – October 30, 2004

Outline

- Motivation – possibility to measure photons at low p_T
- Technique – photon conversions in beam pipe
 - Invariant mass spectra of e^+e^- pairs
 - Conversion pair properties
 - Extraction of conversion pairs
- Raw photon p_T spectrum
- Outlook

Motivation

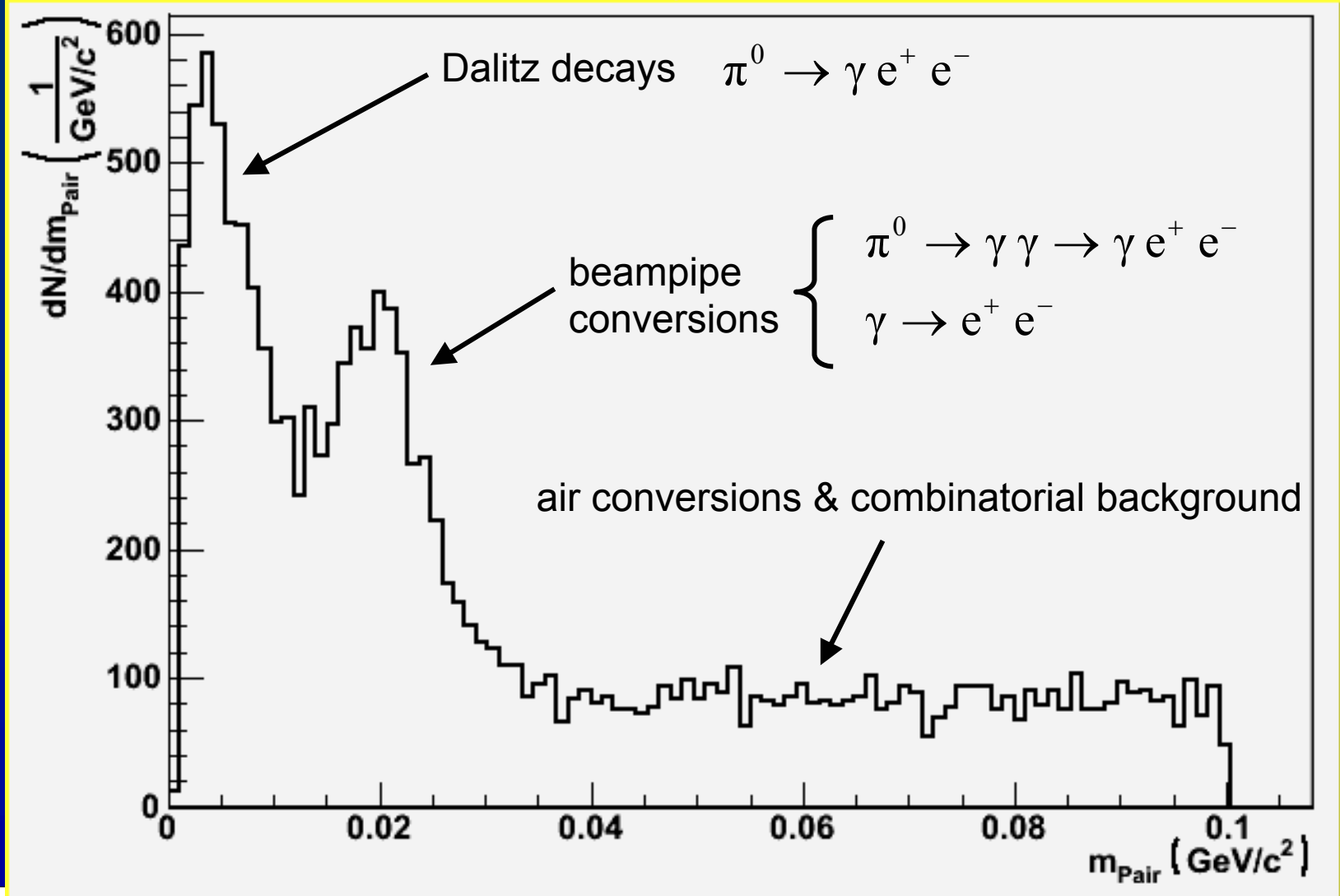
- Thermal photons carry information about initial temperature of produced medium
- Direct photons have been measured in PHENIX
 - Used method has systematic errors $\sim 30\%$
 - Expected contribution of thermal photons at 2 GeV $\sim 10\%$
- New method with smaller systematic errors
 - Reconstruct e^+e^- from photon conversions
 - Goal: sys. errors $< 10\%$



Mechanism

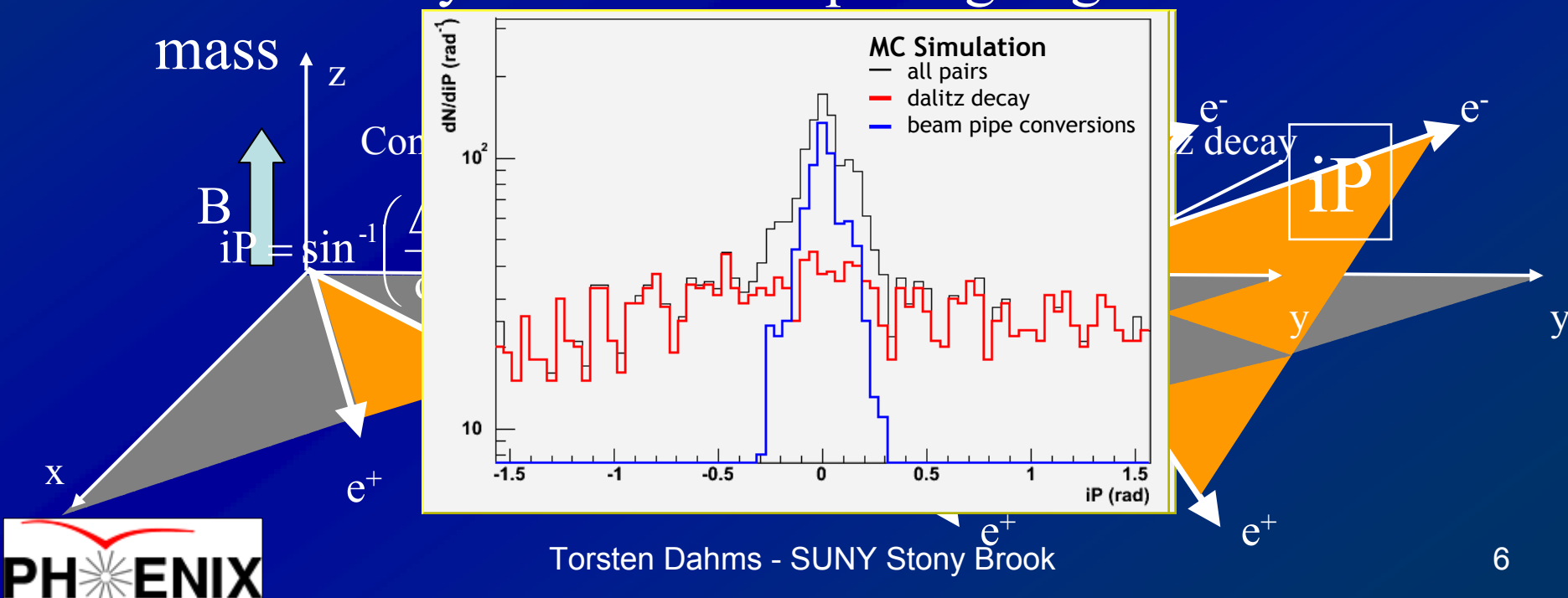
- Reconstruct electron positron pairs
- Conversion pairs are created in the beam pipe ($r \approx 4\text{cm}$)
 - PHENIX momentum reconstruction relies on $\int B dl$
$$\int_r^\infty B dl < \int_0^\infty B dl \Rightarrow p_T^{\text{true}} < p_T^{\text{reco}} \Rightarrow m_{ee} > 0$$
 - Leads to higher momentum
 - Pairs get an invariant mass > 0
 - Invariant mass is proportional to the distance from collision vertex
- Conversion peak artificially shifts w. r. t. to Dalitz decays

Invariant e^+e^- mass spectrum of Run 4 Au+Au: $\sqrt{s_{NN}} = 62.4$ GeV

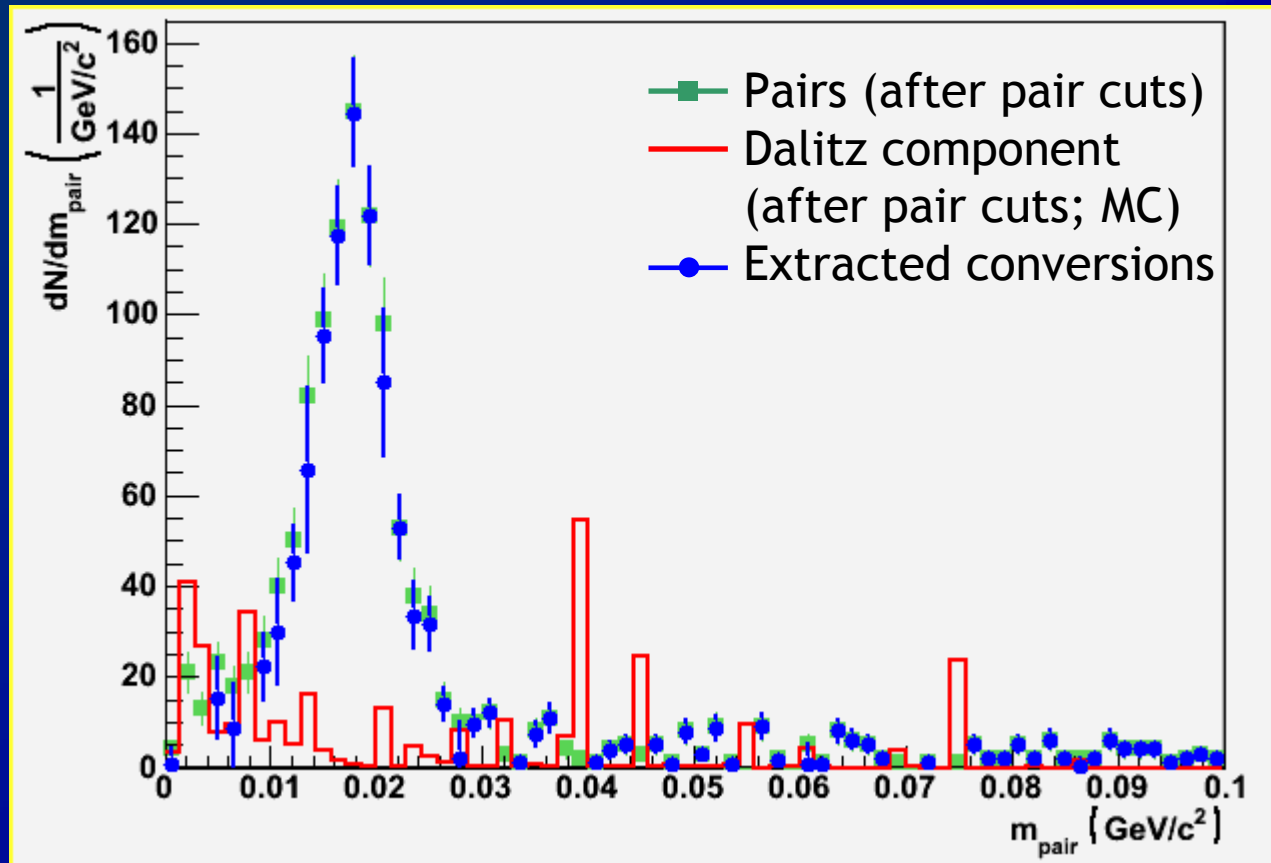


Pair properties

- Conversion pairs have small intrinsic opening angle
 - magnetic field produces opening of the pair in azimuth direction $\Delta\varphi_0 = \varphi_0(e^-) - \varphi_0(e^+) < 0$
 - orientation perpendicular to the magnetic field
- Dalitz decays have a real opening angle due to the π^0

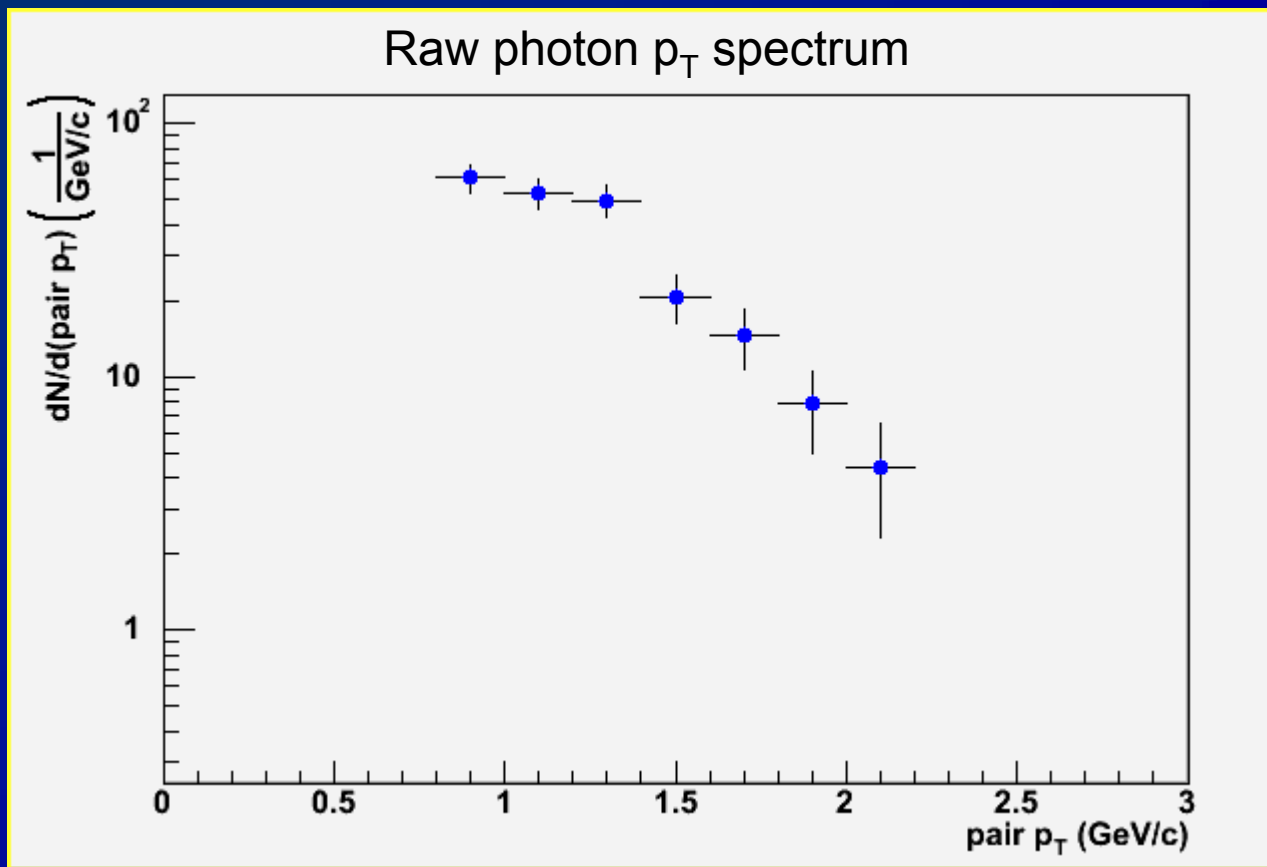


Extraction of conversion pairs



- Pair cuts and subtraction of remaining Dalitz background can select a clean beam pipe conversion peak

Photon p_T spectrum



- Uncorrected photon p_T spectrum
- Dominated by $\pi^0 \rightarrow \gamma \gamma$, which is **not** subtracted yet

Outlook

- Next steps:
 - Correction for acceptance and reconstruction efficiency
 - Absolute normalization of data
 - Subtract known γ sources ($\pi^0 \rightarrow \gamma\gamma, \dots$)
 - Evaluate systematic errors
- Anticipated results:
 - AuAu 62.4 GeV statistics limited (upper limit)
 - AuAu 200 GeV systematics limited
 - Goal: reduce systematic errors $< 10\%$